A particle is executing simple harmonic motion with time period $T$. What is the time taken by the particle to go directly to $\frac{1}{\sqrt{2}}$ of its amplitude from its mean position?

Options:

1. $\frac{T}{8}$
2. $\frac{T}{4}$
3. $\frac{T}{12}$
4. $T$
A block of mass \( m \) rigidly attached with a spring of spring constant \( K \), is compressed through a small distance \( A \). If the block is now released, the time taken by the block in going from \( P \) to \( Q \) will be

\[ \text{Options:} \]

\[ \frac{3}{4\pi} \sqrt{\frac{m}{K}} \]

6760334055.

\[ \frac{2\pi}{3} \sqrt{\frac{m}{K}} \]

6760334056.

\[ \frac{3\pi}{4} \sqrt{\frac{m}{K}} \]

6760334057.

\[ \frac{3\pi}{4} \sqrt{\frac{K}{m}} \]

6760334058.

---

**Question Number : 3  Question Id : 6760331353  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1**

One mole Argon gas is sealed inside a thermally isolated chamber of 1 litre. A 100 W heater kept inside the chamber is switched on for 30 seconds. What will be the rise in temperature of the Argon gas? \([R = 8.314 \text{ J mol}^{-1} \text{K}^{-1}]\)

**Options :**
Problem 1: A solid sphere of radius $R$ has mass $M$. A rod of mass $m$ is attached tangentially to the sphere. What would be the moment of inertia of the system about the axis of the rod, if its diameter is negligibly small compared to $R$?

Options:

- $MR^2$
- $1.4\ MR^2$
- $1.6\ MR^2$
- $4.4\ MR^2$

Problem 2: A solid sphere of radius $R$ has mass $M$. A rod of mass $m$ is attached tangentially to the sphere. What would be the moment of inertia of the system about the axis of the rod, if its diameter is negligibly small compared to $R$?

Options:

- $MR^2$
- $1.4\ MR^2$
- $1.6\ MR^2$
- $4.4\ MR^2$
One end of a metal wire is fixed at the centre of a uniform disc of radius 4.0 cm and mass 100 g. The other end of the wire is fixed with a clamp. The hanging disc is rotated about the wire through a small angle and is released. If the disc makes torsional oscillations with time period 0.20 s, the torsional constant of wire is (Given $\pi^2 = 10$)

Options:

6760334067. $4 \times 10^{-2} \text{ kg m}^2\text{s}^{-2}$

6760334068. $8 \times 10^{-2} \text{ kg m}^2\text{s}^{-2}$

6760334069. $1.2 \times 10^{-2} \text{ kg m}^2\text{s}^{-2}$

6760334070. $8 \times 10^{-1} \text{ kg m}^2\text{s}^{-2}$

Question Number: 6 Question Id: 6760331356 Question Type: MCQ Option Shuffling: Yes Is Question Mandatory: No Correct Marks: 4 Wrong Marks: 1
A particle is projected from the mid-point of the line joining two fixed particles each of mass $m$ in free space. If the separation between the fixed particles is $l$, the minimum velocity of projection of the particle so as to escape to far away is equal to

Options:

1. $2\sqrt{\frac{2Gm}{l}}$
2. $\sqrt{\frac{Gm}{l}}$
3. $\sqrt{\frac{2Gm}{l}}$
4. $\frac{2}{\sqrt{Gm}}$

A solid sphere of mass $M$ and radius $R$ lies on a horizontal rough surface. A horizontal force $F$ is applied at the centre of the sphere. The acceleration of the centre of the sphere will be:

Options:
A projectile is thrown with initial velocity of $(3\hat{i} + 4\hat{j})\text{m/s}$. Here $\hat{i}$ is along the horizontal direction and $\hat{j}$ is assumed in vertical direction. The equation of the trajectory is - (Take $g = 10 \text{ m/s}^2$)

Options:

6760334079. $9y = 12x - 5x^2$

6760334080. $9y = 4x - 5x^2$

6760334081. $9y = 4x - 25x^2$
5y = 12x - 9x^2

The velocity of a particle starting from origin which is set into motion at \( t = 0 \) varies as \( V = V_0(2-t) \), where \( V_0 \) is a positive constant. Find the distance covered and displacement by the particle in 4 second.

Options:

- \( 4V_0, 0 \)
- \( 4V_0, V_0 \)
- \( V_0, 4V_0 \)
- \( V_0, 0 \)
The following diagram shows the relation between stress and strain of two materials A and B. The ratio of Young's modulus of A and B is -

![Diagram showing stress and strain with angles 60° and 30°]

Options:
6760334087. 1 : 3
6760334088. 1 : 1
6760334089. 3 : 1
6760334090. 1 : $\sqrt{2}$

An electric charge $10^{-2}\mu C$ is placed at the origin (0, 0) of X–Y coordinate system. The coordinates of two points A and B are $(\sqrt{2}, \sqrt{2})$ and (2, 0), respectively. The potential difference between the point A and B will be -

Options:
6760334091. 4 $V$
If $A$, $Z$ and $M$ represents the number of nucleons, protons and mass of the nucleus respectively, then mass defect $\Delta M$ is represented by

$(m_p$ and $m_n$ are mass of a proton and a neutron respectively)

Options:

$\Delta M = [A m_p + (A - Z) m_n] - M$

$\Delta M = [A m_p + (A - Z) m_n] - M$

$\Delta M = [Z m_n + (A - Z) m_p] - M$

$\Delta M = [Z m_p + (A - Z) m_n] - M$
A magnetic needle of length 12 cm, suspended at its middle point by a thread, stays at an angle of 45° with the horizontal. If the pole strength of the needle is 2.4 Am, what vertical force should be applied to an end so as to keep it in horizontal position? The horizontal component of the earth's magnetic field is 20 μT.

Options:

6760334099. $4.8 \times 10^{-5} N$

6760334100. $2.4 \times 10^{-5} N$

6760334101. Zero

6760334102. $9.6 \times 10^{-5} N$

Two concentric and coplanar circular coils have radius $a$ and $b (>>a)$ as shown in figure. Resistance of the inner coil is $R$. Current in the outer coil is increased from 0 to $i$, then total charge circulating the inner coil is

Options:

6760334103. $\frac{\mu_0 i \pi a}{2R}$
\begin{align*}
\frac{\mu_0 i^2 \pi a}{2R} \\
6760334104. \\
\frac{\mu_0 i^2 \pi a}{3R} \\
6760334105. \\
\frac{\mu_0 i \pi a^2}{2Rb} \\
6760334106.
\end{align*}

Question Number : 15 Question Id : 6760331365 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
To view a small object with angular magnification 5, the power of the microscope needed is [The final image is formed at infinity] (Distance of distinct vision = 25 cm)
Options :
6760334107. 5 D
6760334108. 10 D
6760334109. 20 D
6760334110. 25 D

Question Number : 16 Question Id : 6760331366 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
If a man having the least distance of distinct vision of 50 cm, what should be the focal length of the spectacles for the man?

Options:

6760334111. $-50\,cm$

6760334112. $+50\,cm$

6760334113. $+100\,cm$

6760334114. $+25\,cm$

Identify the resulting gate for the following circuit.

Options:

6760334115. OR Gate

6760334116. Exclusive-OR gate

6760334117. NOR gate

6760334118. AND gate
Question Number : 18  Question Id : 6760331368  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No
Correct Marks : 4  Wrong Marks : 1
A radioactive isotope has a half life of T years. After how much time is its activity reduced to 6.25% of its original activity?
Options :
6760334119. 2 T years
6760334120. 4 T years
6760334121. 1.5 T years
6760334122. 1 T year

Question Number : 19  Question Id : 6760331369  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No
Correct Marks : 4  Wrong Marks : 1
Given below are two statements: one is labeled as Assertion A and the other is labeled as Reason R.

**Assertion A :** Communication techniques which are using much higher frequencies like TV signal broadcast, can not be received beyond the line-of-sight.

**Reason R :** Radio waves used for radio broadcast which are in the below critical frequency range, receive reflection from the ionosphere and can be received by the receiving antenna.

In the light of the above statements, choose the correct answer from the options given below.
Options :
6760334123. Both A and R are true and R is the correct explanation of A.

6760334124. Both A and R are true but R is NOT the correct explanation of A.

6760334125. A is true but R is false.

6760334126. A is false but R is true.

Question Number : 20 Question Id : 6760331370 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
A block of mass 4.0 kg is pulled up on a smooth incline of angle 30° with the horizontal. If the block moves with an acceleration of 1.0 m/s², the power delivered by the pulling force at a time 3.0 s after the motion starts is

Options :
6760334127. 70.8 W

6760334128. 35.4 W

6760334129. 65.4 W

6760334130. 85.4 W

Physics Section B

Section Id : 67603392
Section Number : 2
Section type : Online
Question Number : 21 Question Id : 6760331371 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

\[ \times 10^{-10} \text{ J (joule) energy is contained in a 120 m length of a laser beam operating at 4mW.} \]
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

100

Question Number : 22 Question Id : 6760331372 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The magnetic flux linked with a coil at any instant ‘t’ is given by
\[ \phi = 5t^3 - 100t + 300 \text{ (SI unit). The emf induced in the coil at } t = 2 \text{ s is} \]
\[ \frac{}{ } \text{ V}. \]
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

100

Question Number : 23 Question Id : 6760331373 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The ratio of shortest wavelength to the largest wavelength in Brackett series of atomic spectra for hydrogen atom is $x : 25$, where the value of $x$ is _____.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

100

Question Number : 24 Question Id : 6760331374 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
A train left the station at uniform acceleration of 2 m/s$^2$. A man behind the train at a distance of 5 m is running with a constant speed of 6 m/s to catch the train. The time to catch the train will be ________ s.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

100

Question Number : 25 Question Id : 6760331375 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
A sample undergoing beta decay, reduced to \( \frac{1}{16} \) of its initial mass in 48 years. Its half life period is _______ years.

Question Number : 26 Question Id : 6760331376 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Two particles of equal mass ‘\( m \)’ go round a circle of radius \( R \) under the action of their mutual gravitational attraction. The speed of each particle is \( \sqrt{\frac{1}{x} \cdot \frac{Gm}{R}} \)

where \( x \) is _______.

Question Number : 27 Question Id : 6760331377 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
In Young's double slit experiment, 58 fringes are observed in the field of view when a light of wavelength 6000 Å was used. Number of fringes that can be viewed, if another light of wavelength 4000 Å is used are _______.

Question Number : 28 Question Id : 6760331378 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
As the switch S is closed in the circuit shown in figure, current passed through it is _______A.
The electric potential at point \((x, 0, 0)\) is \(V = \left( \frac{1000}{x} + \frac{1500}{x^2} + \frac{500}{x^3} \right)\) volt.

The electric field strength at a point \(x = 1 \text{ m}\) is \(\hat{i} \text{ V/m}\).

A body of mass 20 kg is placed at a latitude of 45° on earth of radius \(R\) and angular speed \(\omega\). The change in weight of the body (if earth stops rotating) is \(xR\omega^2\). The value of \(x\) is _______.

Possible Answers:

100
Given below are two statements:

**Statement I:** In dichromate ion, all the Cr—O bonds are of equal length.

**Statement II:** In dichromate ion, the Cr—O—Cr bond angle is less than the H—O—H bond angle in water.

In the light of the above statements, choose the **correct** answer from the options given below.

**Options:**

1. Both Statement I and Statement II are true
2. Both Statement I and Statement II are false
Statement I is true but Statement II is false

Statement I is false but Statement II is true

Question Number : 32  Question Id : 6760331382  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No
Correct Marks : 4  Wrong Marks : 1
The lowest freezing point among the following solutions will be observed in [Atomic weight : C = 12, Mg = 24, Na = 23, Cl = 35.5, O = 16, N = 14]
Options :
6760334145.  5.85g of NaCl in 500 mL water
6760334146.  6g urea in 500 mL water
6760334147.  18g of glucose in 500 mL water
6760334148.  9.5g of MgCl₂ in 500 mL water

Question Number : 33  Question Id : 6760331383  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No
Correct Marks : 4  Wrong Marks : 1
The correct order of the basic character for the following metal hydroxides is
Options :
6760334149.  Al(OH)₃ > Ca(OH)₂ > Ce(OH)₃ > Lu(OH)₃
6760334150.  Ca(OH)₂ > Ce(OH)₃ > Al(OH)₃ > Lu(OH)₃
Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

**Assertion A:** Fluoride based compound is added during extraction of aluminum from bauxite.

**Reason R:** Alumina is a poor conductor of electricity.

In the light of the above statements, choose the correct answer from the options given below.

**Options:**

6760334153. Both A and R are true and R is the correct explanation of A

6760334154. Both A and R are true but R is NOT the correct explanation of A

6760334155. A is true but R is false

6760334156. A is false but R is true.
Question Number : 35 Question Id : 6760331385 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Which one of the following statements is incorrect?
A. The correct order of increasing first ionization enthalpy is Li < H < F.
B. Out of the three isotopes of hydrogen, two are radioactive
C. Reactivity of halogens is much more than that of hydrogen.
D. The size of H\(^+\) ion is less than 0.1 pm.

Options :
- A only
- B only
- C only
- D only

Question Number : 36 Question Id : 6760331386 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
A white solid (X) on heating forms a solid (Y) and a gas (Z). Another solid (B) forms (X) by reacting with (Z). (Y) can be converted into (X) and (B). What is (Y)?

Options :
- \(\text{CaCO}_3\)
- \(\text{CaO}\)
6760334163. Ca(OH)₂

6760334164. CaCl₂.

**Question Number : 37**  
**Question Id : 6760331387**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**

Silicones are group of organosilicon polymers. Which one among the following acts as a chain terminating unit in silicone polymerization?

**Options :**

6760334165. Si(CH₃)₄

6760334166. Si(CH₃)₃Cl

6760334167. Si(CH₃)₂Cl₂

6760334168. Si(CH₃)Cl₃

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**Question Number : 38**  
**Question Id : 6760331388**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**

Which one of the following set will give coloured aqueous solution?

**Options :**

6760334169. Cu²⁺, V³⁺, Sc³⁺


\[ \text{Sc}^{3+}, \text{Ti}^{4+}, \text{Mn}^{3+} \]

\[ \text{V}^{3+}, \text{Mn}^{3+}, \text{Cu}^{2+} \]

\[ \text{V}^{3+}, \text{Cu}^{2+}, \text{Ti}^{4+} \]

**Question Number : 39**  
**Question Id : 6760331389**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**  

Which one of the following statements is correct?

**Options :**

- Ce\(^{4+}\) is more stable than Ce\(^{3+}\) due to 4f\(^0\) configuration.

- Eu\(^{2+}\) is more stable than Eu\(^{3+}\) due to 4f\(^7\) configuration.

- Ce\(^{4+}\) is an oxidant and Eu\(^{2+}\) is a reducing agent.

- Ce\(^{3+}\) and La\(^{3+}\) salts are colored and paramagnetic.

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**Question Number : 40**  
**Question Id : 6760331390**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**  

The oxidation states of Fe in \([\text{Fe(NCS})(\text{NH}_3)_5]\text{SO}_4\), \(\text{Na}_3[\text{Fe(S}_2\text{O}_3)_3]\) and \([\text{Fe(CO)}_5]\) respectively are

**Options :**
Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

**Assertion A**: Fluoride ion concentration above 2 ppm causes brown mottling of teeth.

**Reason R**: The presence of fluoride ions in drinking water converts hydroxyapatite (tooth enamel) into fluorapatite.

In the light of the above statements, choose the **most appropriate** answer from the options given below.

**Options**:

- Both A and R are correct and R is the correct explanation of A
- Both A and R are correct but R is **NOT** the correct explanation of A
- **A** is correct but R is **NOT** correct
6760334184. A is NOT correct but R is correct.

6760334185. Question Number : 42 Question Id : 6760331392 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
In the detection of nitrogen in an organic compound by Lassaigne’s test, the iron compounds formed are
Options :
6760334186. $\text{[Fe(CN)}_6\text{]}^3^-, \text{Fe[Fe(CN)}_6\text{]}\cdot x\text{H}_2\text{O}$
6760334187. $\text{[Fe(CN)}_6\text{]}^4^-, \text{Fe}_2\text{[Fe(CN)}_6\text{]}\cdot x\text{H}_2\text{O}$
6760334188. $\text{[Fe(CN)}_6\text{]}^4^-, \text{Fe}_4\text{[Fe(CN)}_6\text{]}\cdot x\text{H}_2\text{O}$
6760334189. $\text{[Fe(CN)}_6\text{]}^3^-, \text{Fe}_3\text{[Fe(CN)}_6\text{]}\cdot x\text{H}_2\text{O}$

6760334187. Question Number : 43 Question Id : 6760331393 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
Order of reactivity for hydrolysis of substituted chlorobenzenes in the presence of aqueous NaOH is

\[ \text{(A)} \quad \text{(B)} \quad \text{(C)} \quad \text{(D)} \]

Options:

1. \( C > B > D > A \)
2. \( A > B > C > D \)
3. \( D > C > B > A \)
4. \( B > C > D > A \)

The correct structure of \textit{cis}-2,4-dimethylhept-3-ene is,
Question Number : 45  Question Id : 6760331395  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1
Arrange the following halides in the increasing order of their reactivity towards $S_{N1}$ reaction mechanism.

(A) $\text{ClCH}_2\text{Cl}$  (B) $\text{ClC}_2\text{H}_4\text{Cl}$  (C) $\text{ClC}_2\text{H}_3\text{CH}_3$  (D) $\text{ClC}_6\text{H}_5\text{Cl}$

**Options:**

1. $A < B < D < C$
2. $B < A < D < C$
3. $C < D < B < A$
4. $C < D < A < B$

**Question Number : 46 Question Id : 6760331396 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

Which one of the following reagents are not suitable for the preparation of benzaldehyde from benzene?

**Options :**

- a) $\text{CH}_3\text{Cl} + \text{Anhyd. AlCl}_3$
- b) $\text{CrO}_2\text{Cl}_2 + \text{CS}_2 / \text{H}_3\text{O}^+$
- a) $\text{CH}_3\text{Cl} + \text{Anhyd. AlCl}_3$
- b) $\text{Cl}_2/\text{Fe dark} / \text{H}_2\text{O (373K)}$
In the above reaction sequence the compounds A and B respectively are

Options:

- \( \text{A. } 1) \text{NaNO}_2(\text{aq.}) + \text{HCl} \quad 2) \text{Heat} \quad \text{B. } \text{conc. H}_2\text{SO}_4 \quad \text{ Conc. } \text{NO}_2 \)

- \( \text{OH} \quad \text{NH}_2 \quad \text{OH} \quad \text{CH}_3\text{CH}_2\text{CONH}_2 \quad \text{CH}_3\text{CH}_2\text{CONH}_2 \)

- \( \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \)

- \( \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \)
Question Number: 48  Question Id: 6760331398  Question Type: MCQ  Option Shuffling: Yes  Is Question Mandatory: No  Correct Marks: 4  Wrong Marks: 1

Match List I with II

<table>
<thead>
<tr>
<th>List I</th>
<th>List II (Ion detected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Borax Bead test</td>
<td>I. As$^{3+}$</td>
</tr>
<tr>
<td>B. Charcoal cavity test</td>
<td>II. Al$^{3+}$</td>
</tr>
<tr>
<td>C. Flame test</td>
<td>III. Fe$^{3+}$</td>
</tr>
<tr>
<td>D. Lake test</td>
<td>IV. Sr$^{2+}$</td>
</tr>
</tbody>
</table>

Choose the correct answer from the options given below:

Options:

6760334209.  A – III, B – I, C – IV, D – II

6760334210.  A – IV, B – I, C – II, D – III


Question Number : 49 Question Id : 6760331399 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Select the odd group
Options :

6760334213.  Protein, Starch, Cellulose

6760334214.  Nylon 6, Polythene, Teflon

6760334215.  Rayon, Caprolactum, Buna-S

6760334216.  Nylon 6,6, Dacron, Buna-N

Question Number : 50 Question Id : 6760331400 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Which one of the following represents the correct structure of a dinucleotide?
Options :
Chemistry Section B

Section Id: 67603394
Section Number: 4
Section type: Online
Mandatory or Optional: Mandatory
Question Number : 51 Question Id : 6760331401 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
Chlorine is prepared according to the following equation:

$$4\text{HCl} + \text{MnO}_2(\text{s}) \rightarrow 2\text{H}_2\text{O}(l) + \text{MnCl}_2(\text{aq}) + \text{Cl}_2(\text{g}).$$

10g sample of MnO₂ produces 2.24L of chlorine under SATP, the percentage purity of the MnO₂ sample is ______. (Nearest integer)

[Atomic weight = H : 1.0, O : 16.0, C : 12.0, Cl : 35.5, Mn : 55.0]

[SATP : T = 298K, P = 10^5 \text{ Pa}]
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
100

Question Number : 52 Question Id : 6760331402 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The total kinetic energy of 10 moles of a monoatomic ideal gas at 25°C in kJ is ________. (Nearest integer)

\[ R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \]

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
100

Question Number: 53 Question Id: 6760331403 Question Type: SA
Correct Marks: 4 Wrong Marks: 0
The ratio of radii for the first and third orbits of hydrogen atom is 1 : x. The value of x is ________. (Integer answer)

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
100

Question Number: 54 Question Id: 6760331404 Question Type: SA
Correct Marks: 4 Wrong Marks: 0
The work done by an ideal monoatomic gas when it is taken along the path ABCD as shown in the figure is $xP_0V_0$. The value of $(-x)$ is _______. (Nearest integer)

$[\ln 2 = 0.69]$

The pH of the solution resulted when 150 mL of 0.1 M ammonia solution is titrated with 50 mL of 0.1M HCl $[pK_b(\text{NH}_3) = 4.7]$ is _______. (Nearest integer)

$[\log_{10} 2 = 0.30]$
Question Number : 56 Question Id : 6760331406 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The potential of a cell containing two hydrogen electrodes, one in contact with $10^{-8}$ M H$^+$ concentration and the other in contact with 0.025 M H$^+$ concentration is $x \times 10^{-4}$ V. The value of $x$ is _______. (Nearest integer)

[Given: $\frac{2.303 \, RT}{F} = 0.059$ and $\log_{10} 2 = 0.30$]

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
100

Question Number : 57 Question Id : 6760331407 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The inactivation process of virus is first order with respect to virus concentration and 2% of the virus was inactivated in the first one minute. Time taken (in minutes) for the virus to become 75% inactivated is _______. (Nearest integer)

[Use $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$]

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
In an adsorption isotherm, it is seen that the graph of \( \log \left( \frac{x}{m} \right) \) vs \( \log P \), where \( P \) is in atm, is a straight line inclined at 45° and the intercept is 0.699. The amount of solute in grams adsorbed per gram of adsorbent at a pressure of 0.5 atm is \( x \times 10^{-3} \). The value of \( x \) is ______. (Nearest integer)

[Use \( \log_{10} 2 = 0.3010 \); \( \tan 45^\circ = 1 \)]
The number of isomers with molecular formula C₃H₉N, which will react with CHCl₃ + KOH is ________. (Integer answer)
Let $\mathbb{R}$ be the set of real numbers and `$*$' be a binary operation on $\mathbb{R} - \{0\}$ defined by

$$a * b = a + 2b + \frac{a}{b}.$$ 

Then the operation `$*$' is

**Options:**

6760334231. associative and commutative

6760334232. commutative but not associative

6760334233. associative but not commutative

6760334234. neither associative nor commutative.

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**Question Number : 62 Question Id : 6760331412 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

If the equations $2x^2 + kx - 5 = 0$ and $x^2 - 3x - 4 = 0$ have one root in common, then a value of `$k$' is

**Options :**

6760334235. $-2$

6760334236. $3$

6760334237. $-3$

6760334238. $2$
Let $A = (a_{ij})$ be a $3 \times 3$ matrix, where $a_{ij} = \max\{i, j\}$. Then $\det A$ is equal to

Options:

6760334239. $7^6$

6760334240. $6 \cdot 7^6$

6760334241. $6^2 \cdot 7^6$

6760334242. $6^3 \cdot 7^6$

Let $A$ be a $3 \times 3$ matrix and $|A| = -1$. A matrix $B$ is obtained from the matrix $A$ by applying the following elementary row operations:

$R_2 \rightarrow R_2 + 3R_1$

$R_3 \rightarrow 3R_3$

$R_1 \rightarrow R_1 - 5R_3$.

Then $|B|$ is equal to:

Options:

6760334243. $-27$
Question Number : 65 Question Id : 6760331415 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
For the system of linear of equations

\[(k - 3) x + y + z = 0\]
\[x + (k - 3) y + z = 0\]
\[x + y + (k - 3) z = 0\]

the number of distinct values of \(k\), for which it has a non-trivial solution, is

Options :

6760334247. 3
6760334248. 2
6760334249. 1
6760334250. 0

Question Number : 66 Question Id : 6760331416 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
In the Binomial expansion of \( \left( 2x\sqrt{x} + 3y^{16} \right)^{33} \), the number of terms, having positive integral powers of \( x \) and \( y \) is:

**Options:**

6760332451. 0

6760332452. 1

6760332453. 2

6760332454. 3

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If ‘\( m \)’ is the arithmetic mean of two distinct real numbers \( l \) and \( n \) (\( l, n > 1 \)) and \( G_1, G_2 \) and \( G_3 \) are three geometric means between \( l \) and \( n \), then \( G_1^4 + 2G_2^4 + G_3^4 \) equals

**Options:**

6760332455. \( 2l^2mn \)

6760332456. \( 4l^2n \)

6760332457. \( 4lm^2 \)

6760332458. \( 2lm^2n^2 \)

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**Question Number : 68**

**Question Id : 6760331418**

**Question Type : MCQ**

**Option Shuffling : Yes**

**Is Question Mandatory : No**
\[
\lim_{x \to 0} \frac{1}{e^{x-1}} (1 + x) = \text{is equal to}
\]

Options:

6760334259. 0
6760334260. 1
6760334261. \(e\)
6760334262. \(e^e\)

---

Question Number: 69  Question Id: 6760331419  Question Type: MCQ  Option Shuffling: Yes  Is Question Mandatory: No  Correct Marks: 4  Wrong Marks: 1

If for non-zero distinct real numbers \(a, b\) and \(c\),

\[
f(x) = \begin{cases} 
 x\alpha + \sqrt{2}a \sin x, & 0 \leq x < \frac{\pi}{4} \\
 2x\alpha \cot x - c \sin 2x, & \frac{\pi}{4} \leq x < \frac{\pi}{2} \\
 -8ac \cos 2x - \pi ab, & \frac{\pi}{2} \leq x \leq \pi 
\end{cases}
\]

is continuous on \([0, \pi]\), then

Options:

6760334263. \(a, b, c\) are in A.P.
\frac{1}{a}, \frac{1}{b}, \frac{1}{c} \text{ are in A.P.}

6760334264.

\frac{1}{a}, b, c \text{ are in G.P.}

6760334265.

\frac{1}{a} + \frac{2}{b} + \frac{1}{c} = 0

6760334266.

Question Number : 70 Question Id : 6760331420 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Let \( f : \mathbb{R} \to \mathbb{R} \) be a differentiable function such that \( f(0) = 2 \). If \( \left| \frac{df}{dx} \right| \leq 3 \), for all \( x \in \mathbb{R} \), then \( f(1) \) lies in the interval

Options :

6760334267. \([5, \infty)\)

6760334268. \((-\infty, -1]\)

6760334269. \([-1, 5]\)

6760334270. \((-\infty, -1) \cup (5, \infty)\)

Question Number : 71 Question Id : 6760331421 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
If the function \( f : \mathbb{R} \to \mathbb{R} \) defined by \( f(x) = \frac{x^3}{3} - (2a + 3b)x^2 + 2abx + 5 \) has a local maxima at \(-4\) and a local minima at \(4\), then a value of \(4a + 3b\) is

**Options:**

1

\(\frac{1}{2}\)

6760334271.

2

6760334272.

0

6760334273.

1

6760334274.

The integral \( \int \frac{dx}{\sqrt{2x} + 5 - \sqrt{2x} + 3} \) is equal to

(\text{where} \ C \ \text{is a constant of integration})

**Options:**

\(\frac{1}{3} \left[ (2x + 5)^\frac{3}{2} + (2x + 3)^\frac{3}{2} \right] + C\)

6760334275.

\(\frac{1}{6} \left[ (2x + 5)^\frac{2}{3} + (2x + 3)^\frac{2}{3} \right] + C\)

6760334276.
\[ \frac{1}{6} \left[ \left(2x + 5\right)^3 + \left(2x + 3\right)^3 \right] + C \]

\[ \frac{1}{12} \left[ \left(2x + 5\right)^2 + \left(2x + 3\right)^2 \right] + C \]

**Question Number : 73**

**Question Id : 6760331423**

**Question Type : MCQ**

**Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4**

**Wrong Marks : 1**

A curve passes through the point \((-1, 4)\). If the normal to it at any point \((x, y)\) on it passes through \((2, 0)\), then its equation is

**Options :**

\[ (x - 2)^2 + y^2 = 25 \]

\[ 2(x - 2)^2 + y^2 = 34 \]

\[ 2y^2 - (x - 2)^2 = 23 \]

\[ y^2 - (x - 2)^2 = 7 \]

**Question Number : 74**

**Question Id : 6760331424**

**Question Type : MCQ**

**Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4**

**Wrong Marks : 1**

If an ellipse passes through the point \((4, 1)\) and has foci at \((\pm 3, 0)\), then its eccentricity is
The tangents, to the parabola $y^2 = 2 - x$ at the points of its intersection with the line $y = x - 2$, intersect at the point.

Options:

$\left(-\frac{1}{2}, 2\right)$

$\left(2, -\frac{1}{2}\right)$

$(2, 0)$
Let $L_1$ and $L_2$ be two lines passing through the points $P(b - c, c - a, a - b)$ and $Q\left(\frac{1}{l}, \frac{1}{m}, \frac{1}{n}\right)$ respectively, where $\frac{1}{l}, \frac{1}{m}$ and $\frac{1}{n}$ are the $a^{th}$, $b^{th}$ and $c^{th}$ terms of an Arithmetic Progression. If $L_1$ and $L_2$ intersect at the origin, then an angle between them is

Options:

\[
\frac{\pi}{3}
\]

\[
6760334291.
\]

\[
\frac{\pi}{2}
\]

\[
6760334292.
\]

\[
\frac{\pi}{4}
\]

\[
6760334293.
\]

\[
\frac{\pi}{6}
\]

\[
6760334294.
\]
A plane intersects the $yz$-plane at $x = 0$, $2y - 3z = 5$ and it intersects the $xy$-plane at $z = 0$, $7x + 4y = 10$. Then the distance of the point $(1, -2, -1)$ from this plane is

Options:

$\frac{1}{\sqrt{101}}$

6760334295.

$\frac{3}{\sqrt{101}}$

6760334296.

$\frac{5}{\sqrt{101}}$

6760334297.

$\frac{7}{\sqrt{101}}$

6760334298.

Question Number : 78 Question Id : 6760331428 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A dice is thrown twice. If $A$ is the event that the sum of numbers appearing on them is 7 and $B$ is the event that number 5 appears at least once, then $P(B|A)$ is equal to

Options:

$\frac{1}{2}$

6760334299.

$\frac{1}{3}$

6760334300.
\[ \frac{2}{11} \]

\[ \frac{2}{5} \]

**Question Number** : 79  **Question Id** : 6760331429  **Question Type** : MCQ  **Option Shuffling** : Yes  **Is Question Mandatory** : No  
**Correct Marks** : 4  **Wrong Marks** : 1  
The maximum value of \((\cos\theta_1)\cdot(\cos\theta_2)\cdot(\cos\theta_3)\cdots(\cos\theta_{10})\) under the restrictions \(0 < \theta_1, \theta_2, \ldots, \theta_{10} < \frac{\pi}{2}\) and \((\cot\theta_1)\cdot(\cot\theta_2)\cdots(\cot\theta_{10}) = 1\) is

**Options** :

1. \[ \frac{1}{512} \]
2. \[ \frac{1}{1024} \]
3. \[ \frac{1}{32} \]

**Question Number** : 80  **Question Id** : 6760331430  **Question Type** : MCQ  **Option Shuffling** : Yes  **Is Question Mandatory** : No  
**Correct Marks** : 4  **Wrong Marks** : 1  
The statement \(\sim (p \leftrightarrow \sim q)\) is equivalent to

**Options** :
\[ p \leftrightarrow q \]

\[ p \leftrightarrow \sim q \]

\[ \sim q \rightarrow p \]

\[ \sim p \land q \]

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Mathematics Section B

Section Id : 67603396
Section Number : 6
Section type : Online
Mandatory or Optional : Mandatory
Number of Questions : 10
Number of Questions to be attempted : 5
Section Marks : 20
Enable Mark as Answered Mark for Review and Clear Response : Yes
Sub-Section Number : 1
Sub-Section Id : 67603396
Question Shuffling Allowed : Yes

Question Number : 81 Question Id : 6760331431 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The number of elements in the set \( \{ x \in \mathbb{R} : (|x| - 2) \cdot |2x + 3| = 1 \} \) is \underline{}.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
If six letter words (with or without meaning) are formed using A, B, C, D, E and F, then the number of words, in which exactly one of these alphabets is repeated three times and the other three are distinct, is _______.

If the sum of all 3-digit numbers which are multiples of 9 is $41k$, then ‘$k$’ is equal to _______.

If the sum of all 3-digit numbers which are multiples of 9 is $41k$, then ‘$k$’ is equal to _______.
If \([x]\) denotes the greatest integer \(\leq x\), then the value of \(\int_{-2}^{4} |[x] - x| \, dx\) is _______.

Question Number : 85  Question Id : 6760331435  Question Type : SA
Correct Marks : 4  Wrong Marks : 0
If the area (in sq. units) bounded by the parabolas \(5x^2 - y = 0\) and \(2x^2 - y + b = 0\) \((b > 0)\) is \(12\sqrt{3}\), then ‘\(b\)’ is equal to _______.

Question Number : 86  Question Id : 6760331436  Question Type : SA
Correct Marks : 4  Wrong Marks : 0
The circles, \(x^2 + y^2 + 2x + 4y - 4 = 0\) and \(x^2 + y^2 - 4x + 4y + k = 0\) touch each other internally. If the point of contact of these circles is \((a, b)\), then \(5\left(a^2 + b^2\right)\) is equal to _______.

Question Number : 86  Question Id : 6760331436  Question Type : SA
Correct Marks : 4  Wrong Marks : 0
The circles, \(x^2 + y^2 + 2x + 4y - 4 = 0\) and \(x^2 + y^2 - 4x + 4y + k = 0\) touch each other internally. If the point of contact of these circles is \((a, b)\), then \(5\left(a^2 + b^2\right)\) is equal to _______.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
100
If the solution \( y = y(x) \) of the differential equation \( \left(y + 3x^4\right) \frac{dx}{dy} = x, \ x > 0 \), satisfies

\[ y(1) = -1, \] then the value of \( \frac{d^2y}{dx^2} - \frac{dy}{dx} + y \) at \( x = 2 \) is ________.

The mean and variance of 7 observations are 7 and 18 respectively. If 5 of the observations are 2, 4, 10, 11, 13 and the remaining observations are \( x \) and \( y \), then \( xy \) is equal to ________.
A vertical pole of height $10\sqrt{3}$ meters is observed from three points, A, B and C in the same horizontal line passing through the foot ‘O’ of the pole. The angles of elevation of the top, ‘P’, of the pole from A, B and C are in A.P. If $AP = 20\sqrt{3}$ meters, $OC = 10$ meters and $BP = k$ meters, then $k^2$ is equal to ________.

Let $\vec{a} = 2\hat{i} + \alpha\hat{j} + \hat{k}$ and $\vec{b} = \beta\hat{i} - 5\hat{j} + \gamma\hat{k}$, where $\alpha$, $\beta$ and $\gamma$ are real numbers. If $\vec{a} \times \vec{b} = 26\hat{i} - 11\hat{j} - 19\hat{k}$, then $\alpha - \beta + \gamma$ is equal to ________.